Alcohol Use and Alcohol-Related Problems Before and After Military Combat Deployment

I. G. Jacobson
M. A. K. Ryan, T. I. Hooper, T. C. Smith
P. J. Amoroso, E. J. Boyko, G. D. Gackstetter
T. S. Wells, N. S. Bell

Naval Health Research Center

Alcohol Use and Alcohol-Related Problems Before and After Military Combat Deployment

Isabel G. Jacobson, MPH

Margaret A. K. Ryan, MD, MPH

Tomoko I. Hooper, MD, MPH

Tyler C. Smith, PhD, MS

Paul J. Amoroso, MD, MPH

Edward J. Boyko, MD, MPH

Gary D. Gackstetter, DVM, PhD, MPH

Timothy S. Wells, DVM, PhD, MPH

Nicole S. Bell, ScD, MPH

S UBSTANCE ABUSE IS HIGHLY COR-related with posttraumatic stress disorder (PTSD) and other psychological disorders that may occur after stressful and traumatic events, such as those associated with war.[1-7] Published studies of military personnel deployed to Iraq and Afghanistan confirm the association between stress related to combat and adverse mental health consequences and report significantly higher rates of PTSD, major depression, and alcohol misuse postdeployment.[8-12] Similar findings have been reported among Vietnam[13,14] and 1991 Gulf War veterans.[15,16] Many of these studies, however, have been limited by the lack of adequate comparison groups for combat veterans and by the inability to control for baseline factors that might influence the association between combat, mental health outcomes, and alcohol misuse.[17]

Because alcohol use may serve as a coping mechanism after traumatic events, it is plausible that deployment is associated with increased rates of alcohol consumption or problem drinking. It is also possible that depression, PTSD, or stressors related to deploy-

Context High rates of alcohol misuse after deployment have been reported among personnel returning from past conflicts, yet investigations of alcohol misuse after return from the current wars in Iraq and Afghanistan are lacking.

Objectives To determine whether deployment with combat exposures was associated with new-onset or continued alcohol consumption, binge drinking, and alcohol-related problems.

Design, Setting, and Participants Data were from Millennium Cohort Study participants who completed both a baseline (July 2001 to June 2003; n=77 047) and follow-up (June 2004 to February 2006; n=55 021) questionnaire (follow-up response rate=71.4%). After we applied exclusion criteria, our analyses included 48 481 participants (active duty, n=26 613; Reserve or National Guard, n=21 868). Of these, 5510 deployed with combat exposures, 5661 deployed without combat exposures, and 37 310 did not deploy.

Main Outcome Measures New-onset and continued heavy weekly drinking, binge drinking, and alcohol-related problems at follow-up.

Results Baseline prevalence of heavy weekly drinking, binge drinking, and alcohol-related problems among Reserve or National Guard personnel who deployed with combat exposures was 9.0%, 53.6%, and 15.2%, respectively; follow-up prevalence was 12.5%, 53.0%, and 11.9%, respectively; and new-onset rates were 8.8%, 25.6%, and 7.1%, respectively. Among active-duty personnel, new-onset rates were 6.0%, 26.6%, and 4.8%, respectively. Reserve and National Guard personnel who deployed and reported combat exposures were significantly more likely to experience new-onset heavy weekly drinking (odds ratio [OR], 1.63; 95% confidence interval [CI], 1.36-1.96), binge drinking (OR, 1.46; 95% CI, 1.24-1.71), and alcohol-related problems (OR, 1.63; 95% CI, 1.33-2.01) compared with nondeployed personnel. The youngest members of the cohort were at highest risk for all alcohol-related outcomes.

Conclusion Reserve and National Guard personnel and younger service members who deploy with reported combat exposures are at increased risk of new-onset heavy weekly drinking, binge drinking, and alcohol-related problems.

JAMA. 2008;300(6):663-675 www.jama.com

ment or return from deployment may make it more difficult to control the effects of alcohol, resulting in greater alcohol-related problems, with or without a commensurate change in weekly drinking. Similarly, baseline overall drinking quantities may remain relatively unchanged while binge drinking increases. The Millennium Cohort Study[18] is positioned to prospectively describe alcohol consumption patterns and alcohol-related problems among US service members, many of
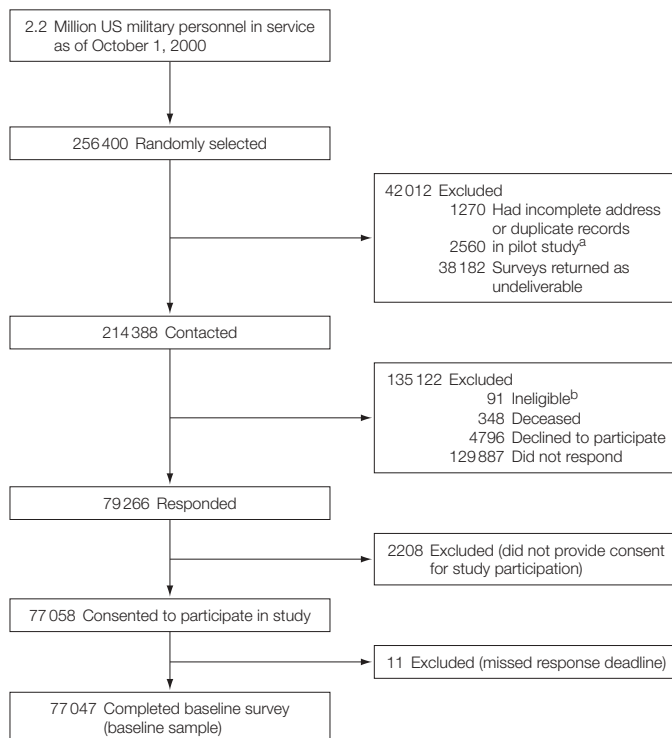
Author Affiliations: Department of Defense Center for Deployment Health Research, Naval Health Research Center, San Diego, California (Drs Ryan and Smith and Ms Jacobson); Department of Preventive Medicine and Biometrics, Uniformed Services University of the Health Sciences, Bethesda, Maryland (Dr Hooper); Madigan Army Medical Center, Fort Lewis, Washington (Dr Amoroso); Seattle Epidemiologic Research and Information Center, Department of Veterans Affairs Puget Sound Health Care System, Seattle, Washington (Dr Boyko); Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, Ohio (Dr Wells); Analytic Services Inc, Arlington, Virginia (Dr Gackstetter); and Social Sectors Development Strategies Inc, Tacoma, Washington (Dr Bell).
Corresponding Author: Isabel G. Jacobson, MPH, DoD Center for Deployment Health Research, Naval Health Research Center, 140 Sylvester Road, San Diego, CA 92106-3521 (Isabel.Jacobson@med.navy.mil).
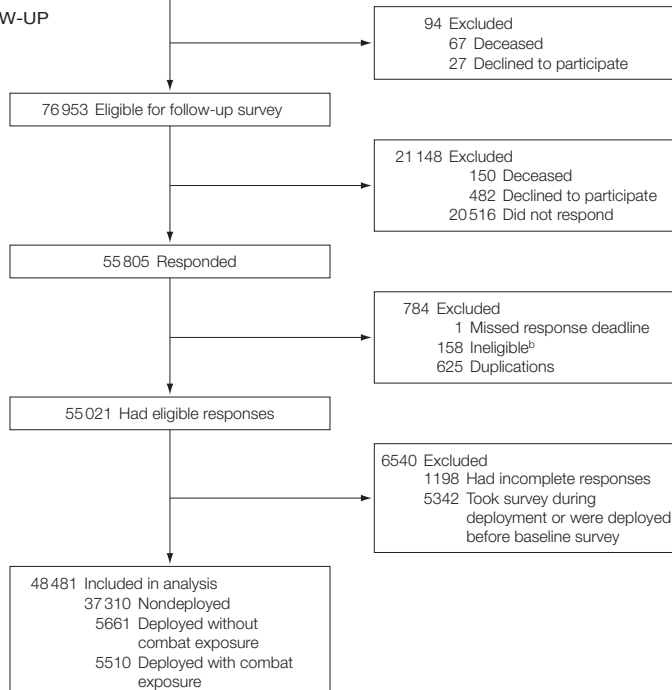
Figure. Millennium Cohort Study Flow of Participants From Original Sample to Baseline and Follow-up Enrollments to Final Study Population

BASELINE

2.2 Million US military personnel in service as of October 1, 2000

256 400 Randomly selected

42 012 Excluded
  1270 Had incomplete address or duplicate records
  2560 in pilot study[a]
  38 182 Surveys returned as undeliverable

214 388 Contacted

135 122 Excluded
  91 Ineligible[b]
  348 Deceased
  4796 Declined to participate
  129 887 Did not respond

79 266 Responded

2208 Excluded (did not provide consent for study participation)

77 058 Consented to participate in study

11 Excluded (missed response deadline)

77 047 Completed baseline survey (baseline sample)

FOLLOW-UP

94 Excluded
  67 Deceased
  27 Declined to participate

76 953 Eligible for follow-up survey

21 148 Excluded
  150 Deceased
  482 Declined to participate
  20 516 Did not respond

55 805 Responded

784 Excluded
  1 Missed response deadline
  158 Ineligible[b]
  625 Duplications

55 021 Had eligible responses

6540 Excluded
  1198 Had incomplete responses
  5342 Took survey during deployment or were deployed before baseline survey

48 481 Included in analysis
  37 310 Nondeployed
  5661 Deployed without combat exposure
  5510 Deployed with combat exposure

[a]The 2560 individuals included in the pilot or feasibility study were removed from the mailing list so they would not receive an additional survey.
[b]Individuals were considered ineligible if they had an invalid Social Security number, were not serving in the military as of October 1, 2000, or if the survey was filled out by someone other than the invited individual.

whom deployed in support of the wars in Iraq and Afghanistan. The purpose of this exploratory investigation was to determine whether military deployment was associated with new-onset or changes in alcohol consumption, binge drinking behavior, and other alcohol-related problems.

METHODS

Population and Data Sources

The Millennium Cohort Study[18] was launched in 2001, with the primary goal of prospectively evaluating the long-term health of military service members and the potential influence of deployment and other military exposures on health. The population-based sample was randomly selected from all US military personnel on rosters as of October 1, 2000. Members of the Reserve and National Guard (Reserve/Guard), women, and those deployed to southwest Asia, Bosnia, or Kosovo between 1998 and 2000 were oversampled to ensure adequate statistical power to detect differences in these smaller subgroups.

This study was approved by the institutional review board at the Naval Health Research Center. A more detailed description of the methodology of this study can be found elsewhere.[18]

With a modified Dillman approach,[19] 77 047 of the 256 400 personnel included in the original sample provided informed, voluntary consent and were enrolled in the first panel of the study. Informed consent included acknowledgment of institutional review board–mandated information and the Privacy Act statement. Of the 77 047 participants who completed a baseline survey (2001-2003), 55 021 (71%) completed a follow-up survey (2004-2006). Individuals were excluded from this study if they deployed to Iraq or Afghanistan before the baseline assessment or if they took their survey while deployed because reporting during deployment would likely differ from reporting after deployment. Individuals also were excluded if they did not answer any alcohol outcome questions or were missing demographic or covariate data (**FIGURE**).

For multivariate modeling, including longitudinal data, participants were analyzed in 2 groups. New onset of alcohol outcomes at follow-up was examined among the group with no alcohol outcomes at baseline. Continued alcohol outcomes at follow-up were examined among the group with reported alcohol outcomes at baseline.

Deployment dates were determined with electronic military data. Individuals categorized as deployed in support of the wars in Iraq and Afghanistan must have completed their first deployment between baseline and follow-up. Length of deployment was assessed as the cumulative amount of time deployed between baseline and follow-up surveys. This variable was categorized as nondeployed, deployed 1 to 180 days, deployed 181 to 270 days, and deployed greater than 270 days. Combat-related exposures, reported at follow-up, were assessed by affirmative responses to questions that asked whether participants had personally witnessed a person's death because of war, disaster, or tragic event; witnessed instances of physical abuse; and seen dead or decomposing bodies, maimed soldiers or civilians, or prisoners of war or refugees.

Demographic and military data were obtained from military electronic personnel files and included sex, birth date, race/ethnicity, service branch (Army, Navy, Air Force, Marines), service component (active duty or Reserve/Guard), military pay grade, military occupation, and deployment experience before baseline to southwest Asia, Bosnia, or Kosovo from 1998 to 2000.

Baseline characteristics of the study population were assessed and included in these analyses. History of life stress, which included such items as divorce, experiencing a violent assault, or having a family member die, was assessed by applying scoring mechanisms from the Holmes and Rahe Social Readjustment Rating Scale[20,21] to categorize as low/mild, moderate, or severe. Self-reported history of a mental disorder was categorized as those having self-reported symptoms or diagnosis of PTSD only, self-reported symptoms or diagnosis of depression only, and self-

reported symptoms or diagnosis of PTSD and depression, and the "other" mental health category was composed of people who self-reported symptoms of other anxiety disorder or panic disorder; self-reported a diagnosis of schizophrenia, psychosis, or manic-depressive disorder; or reported taking medication for anxiety, depression, or stress. PTSD symptoms were measured with the PTSD Checklist-Civilian Version, a 17-item self-report measure of PTSD symptoms that asks respondents to rate the severity of each symptom during the past 30 days on a 5-point Likert scale, ranging from 1 (not at all) to 5 (extremely).[22] Participants were identified as having PTSD symptoms if they reported a moderate or higher level of at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms (criteria established by the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) [*DSM-IV*]).[23] Other anxiety (6 items) and panic (15 items) symptoms were assessed with the Patient Health Questionnaire instrument.[24-26] Self-reported depression symptoms (9 items) were assessed with the Patient Health Questionnaire instrument (sensitivity=0.93; specificity=0.89)[27] and correspond to the depression diagnosis from the *DSM-IV*.[28]

Baseline survey questions were used to identify nonsmokers, past smokers, or current smokers. History of potential alcohol dependence was evaluated with the CAGE[29,30] (*c*ut back, *a*nnoyed, *g*uilty, *e*ye opener) questions that evaluate whether individuals believed that they needed to cut back on their drinking, felt annoyed at someone who suggested they cut back on drinking, felt guilty about their drinking, or reported needing an eye opener in the morning.

Outcomes

Heavy Weekly Drinking. Heavy weekly drinking, which has shown strong criterion-related validity among military populations in past validation work,[31] was estimated at baseline and follow-up by summing the number of drinks reportedly consumed on each day of the week before completing the ques-

tionnaire. Heavy drinkers were defined as men who consumed more than 14 drinks per week and women who consumed more than 7 drinks per week, according to research indicating that drinking beyond this level may increase the risk for alcohol-related problems.[32-36]

Binge Drinking. Binge drinking was estimated at baseline and follow-up by using the number of drinks consumed on each day of the week before taking the questionnaire or the frequency with which participants consumed 5 or more drinks per day or occasion. Binge drinkers were defined as those who reported drinking 5 or more drinks (for men) or 4 or more drinks (for women) on at least 1 day of the week or those who reported "drinking 5 or more alcoholic beverages" on at least 1 day or occasion during the past year.[37]

Alcohol-Related Problems. Alcohol-related problems were assessed at baseline and follow-up with questions from the Patient Health Questionnaire.[24-26] This instrument asked whether any of the following happened more than once in the last 12 months: (a) you drank alcohol even though a physician suggested that you stop drinking because of a problem with your health; (b) you drank alcohol, were high from alcohol, or were hung over while you were working, going to school, or taking care of children or other responsibilities; (c) you were late for or missed work, school, or other activities because you were drinking or hung over; (d) you had a problem getting along with people while you were drinking; and (e) you drove a car after having several drinks or after drinking too much. For this analysis, individuals who endorsed at least 1 item were classified as having an alcohol-related problem.

Statistical Analysis

These analyses were largely exploratory, marking the first investigation of alcohol use in the Millennium Cohort. Univariate analyses including χ^2 tests of association were used to investigate unadjusted associations between each alcohol outcome and deployment, occupational, demographic, and behavioral characteristics. Initial

analyses were conducted to assess the presence of multicollinearity by using a variance inflation factor of 4 or greater.

Before examination of these data, the variables sex,[38,39] birth year,[40] race/ethnicity,[38,41,42] education,[42-44] marital status,[45] service branch,[46,47] service component,[10,48] military pay grade,[49] occupation,[50] deployment length,[51] deployment to a different conflict before baseline,[52] history of life stressors,[53-55] self-reported symptoms or diagnosis of mental disorders,[5,56] smoking status,[40,57] and history of potential alcohol dependence[58] were considered for analyses according to the literature, and the decision to test for a first-order multiplicative interaction between combat deployment status and service branch was made. Significant associations between reported alcohol measures and independent variables included an investigation of possible confounding while adjusting for all other variables in the model. Variables were considered confounders if they changed the measure of association between alcohol use and deployment by more than 10%.[59] Variables that were not significant in the models ($P<.05$) or were not confounders were removed from the models by using a backward elimination process. Interaction terms were considered significant at $P \leq .10$.

After examination of these data, the covariates sex, birth year, race/ethnicity, service branch, service component, deployment length, history of mental disorders, smoking status, and CAGE/alcohol were found to most influence the relationship of combat deployment and alcohol use and were retained for analyses. Race/ethnicity was included because drinking behaviors and values about alcohol may be tied to racial or cultural values.[41] Race and ethnicity were self-designated by personnel on intake forms, with multiple selections permitted, and captured by the Defense Enrollment Eligibility Reporting System (DEERS). We accessed this information from electronic military files that are created with the reporting system data and in-

cluded a race/ethnicity variable as follows: (1) American Indian/Alaskan native, (2) Asian/Pacific Islander, (3) black, non-Hispanic, (4) white, non-Hispanic, (5) Hispanic, (6) other, and (7) unknown. For the purposes of these analyses, categories were collapsed to black, non-Hispanic, white, non-Hispanic, and other. Because service branch did not significantly modify the relationship between combat deployment and alcohol use and the military experiences of active duty and Reserve/Guard personnel are different, an interaction between combat deployment status and service component was tested and found to be significant. For both active duty and Reserve/Guard populations, separate multivariate logistic regression models were used to compare the adjusted odds of association between deployment to support the wars in Iraq and Afghanistan and new-onset and continued heavy drinking, binge drinking, and alcohol-related problems at follow-up, resulting in a total of 12 models. Because of the exploratory nature of these analyses, no statistical adjustments were made for multiple comparisons. Data management and statistical analyses were performed with SAS software (version 9.1; SAS Institute Inc, Cary, North Carolina).

RESULTS

Of the 77 047 Millennium Cohort baseline participants, 55 021 completed a follow-up questionnaire and 22 026 were nonresponders. The response rate for the follow-up study was calculated as 71.4% with a standard definition from the American Association for Public Opinion Research.[60] For longitudinal data analyses, those with baseline and follow-up data were included. Of these participants, 5342 deployed before taking the baseline survey or took either survey while deployed, 525 were missing alcohol outcome information at baseline or follow-up, and 673 were missing demographic or covariate data, leaving 48 481 individuals for analyses (62.9% of baseline participants).

Participants were further classified into those with and without reported alcohol outcomes at baseline to examine both continued and newly reported alcohol outcomes at follow-up. To ascertain newly reported drinking outcomes, participants reporting alcohol use behavior at baseline were removed from analyses. For analyses of continued alcohol behavior, participants not reporting alcohol outcomes at baseline were removed from analyses.

The demographic characteristics of baseline participants, follow-up participants, and those excluded because of missing baseline or follow-up data are displayed in **TABLE 1**. Of the 48 481 study participants, 5510 (11.4%) were deployed with combat exposures, 5661 (11.7%) were deployed without combat exposures, and 37 310 (77.0%) were not deployed. Proportions of individuals followed up were similar across demographic subgroups among those who deployed with and without combat exposure and those who deployed before baseline or took their survey while deployed, except that those who deployed with combat exposures were more likely to report PTSD symptoms at follow-up. Those excluded because of missing baseline or follow-up data were more likely to be younger, black, non-Hispanic or unknown race/ethnicity, Marines, current smokers, and to report PTSD and depression symptoms or diagnosis at baseline.

Among active-duty personnel, the baseline, follow-up, and new-onset prevalence of all 3 drinking outcomes was highest among those deployed with combat exposures compared with those deployed without combat exposures and nondeployed personnel (**TABLE 2**). Proportionally more women than men reported heavy weekly drinking at baseline and new onset, whereas proportionally more men reported binge drinking and alcohol-related problems at all points. Baseline, follow-up, and new-onset prevalence of all outcomes was highest among those who were younger, white, non-Hispanic, Marines, and current smokers and those

Table 1. Characteristics of Millennium Cohort Participants at Baseline and Follow-up by Deployment and Response Status

Characteristic	Baseline Survey Respondents (n = 77 047)	Follow-up Survey Respondents (n = 48 481) Deployed With Combat Exposures (n = 5510)	Deployed Without Combat Exposures (n = 5661)	Nondeployed (n = 37 310)	Deployed Before Baseline or Took Survey During Deployment (n = 5342)	Excluded Because of Missing Baseline or Follow-up Data[b] (n = 23 224)
Sex						
Male	56 415 (73.2)	4572 (8.1)	4516 (8.0)	25 952 (46.0)	4455 (7.9)	16 920 (30.0)
Female	20 632 (26.8)	938 (4.5)	1145 (5.5)	11 358 (55.1)	887 (4.3)	6304 (30.6)
Birth, y						
Before 1960	16 652 (21.6)	843 (5.1)	1107 (6.6)	10 473 (62.9)	753 (4.5)	3476 (20.9)
1960-1969	29 177 (37.9)	2200 (7.5)	2434 (8.3)	15 029 (51.5)	2177 (7.5)	7337 (25.1)
1970-1979	26 672 (34.6)	2136 (8.0)	1849 (6.9)	10 479 (39.3)	2121 (8.0)	10 087 (37.8)
1980 and later	4546 (5.9)	331 (7.3)	271 (6.0)	1329 (29.2)	291 (6.4)	2324 (51.1)
Race/ethnicity						
White, non-Hispanic	53 589 (69.6)	3751 (7.0)	4200 (7.8)	26 553 (49.5)	3719 (6.9)	15 366 (28.7)
Black, non-Hispanic	10 601 (13.8)	586 (5.5)	620 (5.8)	4692 (44.3)	639 (6.0)	4064 (38.3)
Other	12 796 (16.6)	1173 (9.2)	841 (6.6)	6065 (47.4)	983 (7.7)	3734 (29.2)
Unknown	61 (0.1)				1 (1.6)	60 (98.4)
Service branch						
Army	36 481 (47.4)	3582 (9.8)	1486 (4.1)	17 953 (49.2)	2600 (7.1)	10 860 (29.8)
Air Force	22 357 (29.0)	1170 (5.2)	2980 (13.3)	10 408 (46.6)	1682 (7.5)	6117 (27.4)
Navy and Coast Guard	14 268 (18.5)	402 (2.8)	1004 (7.0)	7435 (52.1)	909 (6.4)	4518 (31.7)
Marine Corps	3941 (5.1)	356 (9.0)	191 (4.8)	1514 (38.4)	151 (3.8)	1729 (43.9)
Service component						
Active duty	43 890 (57.0)	3418 (7.8)	3457 (7.9)	19 738 (45.0)	3645 (8.3)	13 632 (31.1)
Reserve/National Guard	33 157 (43.0)	2092 (6.3)	2204 (6.6)	17 572 (53.0)	1697 (5.1)	9592 (28.9)
Cumulative deployment, d						
Nondeployed	53 659 (69.6)			37 310 (69.5)		16 349 (30.4)
1-180	8906 (11.6)	2359 (26.5)	3843 (43.2)			2704 (30.4)
181-270	3881 (5.0)	1292 (33.3)	1057 (27.2)			1532 (39.5)
>270	5259 (6.8)	1859 (35.3)	761 (14.5)			2639 (50.1)
Other[d]					5342	
History of mental disorders						
None	67 125 (87.1)	4920 (7.3)	5171 (7.7)	32 324 (48.2)	4855 (7.2)	19 855 (29.6)
Depression symptoms/diagnosis	4484 (5.8)	235 (5.2)	239 (5.3)	2388 (53.3)	232 (5.2)	1390 (31.0)
PTSD symptoms/diagnosis	1655 (2.2)	134 (8.1)	77 (4.7)	749 (45.3)	87 (5.3)	608 (36.7)
PTSD and depression symptoms/diagnosis	2516 (3.3)	136 (5.4)	105 (4.2)	1208 (48.0)	103 (4.1)	964 (38.3)
Other mental health disorder symptoms or self-reported psychiatric medication use	1267 (1.6)	85 (6.7)	69 (5.4)	641 (50.6)	65 (5.1)	407 (32.1)
Smoking status						
Nonsmoker	44 312 (57.5)	3202 (7.2)	3440 (7.8)	22 243 (50.2)	3043 (6.9)	12 384 (27.9)
Past smoker	18 275 (23.7)	1271 (7.0)	1306 (7.1)	9321 (51.0)	1222 (6.7)	5155 (28.2)
Current smoker	13 778 (17.9)	1037 (7.5)	915 (6.6)	5746 (41.7)	1037 (7.5)	5043 (36.6)
Unknown	682 (0.9)				40 (5.9)	642 (94.1)
History of potential alcohol dependence[c]						
No	62 789 (81.5)	4453 (7.1)	4625 (7.4)	30 567 (48.7)	4383 (7.0)	18 761 (29.9)
Yes	14 258 (18.5)	1057 (7.4)	1036 (7.3)	6743 (47.3)	959 (6.7)	4463 (31.3)

Abbreviation: PTSD, posttraumatic stress disorder.
[a] Percentages in the first column were calculated as percentage of total baseline population and may not sum to 100 due to rounding. The percentages in the next 5 columns were calculated with the number in each cell as the numerator and the corresponding baseline number in each characteristic as the denominator.
[b] Of the 23 224 personnel who were excluded because of missing baseline or follow-up data, administrative records indicated that 6875 (30%) completed at least 1 deployment after their baseline survey but before February 14, 2006, the last day that follow-up surveys were accepted. However, information on combat exposure was not available from administrative records and therefore could be assessed only for personnel who responded to the follow-up survey.
[c] Potential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.[29,30]
[d] Cumulative deployment length was not calculated for the 5342 individuals who were deployed before the baseline assessment or took the survey while deployed and were excluded from the study.

Table 2. Prevalence of Baseline, Follow-up, and New-Onset Alcohol Use of Active-Duty Millennium Cohort Participants Reporting Outcomes

	No. (%)[a]								
	Heavy Weekly Drinkers			Binge Drinkers			≥1 Drinking-Related Problem		
Characteristic	Baseline (n = 1950)	Follow-up (n = 2037)	New Onset (n = 1185)	Baseline (n = 12 606)	Follow-up (n = 12 323)	New Onset (n = 2836)	Baseline (n = 2516)	Follow-up (n = 1584)	New Onset (n = 889)
Deployment status									
Nondeployed	1396 (7.3)	1485 (7.7)	850 (4.8)	8828 (44.9)	8671 (44.1)	2092 (19.3)	1820 (9.3)	1165 (5.9)	645 (3.6)
Deployed without combat exposures	239 (7.1)	247 (7.4)	154 (4.9)	1811 (52.6)	1740 (50.6)	359 (22.0)	321 (9.3)	172 (5.0)	98 (3.2)
Deployed with combat exposures	315 (9.5)	305 (9.2)	181 (6.0)	1967 (57.6)	1912 (56.0)	385 (26.6)	375 (11.0)	247 (7.2)	146 (4.8)
Sex									
Male	1424 (7.4)	1530 (7.9)	877 (4.9)	10 446 (52.8)	10 221 (51.7)	2118 (22.7)	2058 (10.4)	1291 (6.5)	706 (4.0)
Female	526 (8.0)	507 (7.7)	308 (5.1)	2160 (32.0)	2102 (31.1)	718 (15.6)	458 (6.8)	293 (4.4)	183 (2.9)
Birth, y									
Before 1960	222 (5.8)	272 (7.2)	133 (3.7)	1189 (30.6)	1208 (31.1)	356 (13.2)	220 (5.7)	152 (3.9)	81 (2.2)
1960-1969	628 (5.6)	749 (6.7)	450 (4.3)	4928 (42.8)	4916 (42.7)	1260 (19.2)	757 (6.6)	442 (3.8)	271 (2.5)
1970-1979	921 (9.4)	857 (8.8)	506 (5.7)	5817 (58.0)	5476 (54.6)	1028 (24.4)	1321 (13.2)	815 (8.1)	449 (5.2)
1980 and later	179 (16.4)	159 (14.6)	96 (10.5)	672 (60.2)	723 (64.7)	192 (43.2)	218 (19.6)	175 (15.7)	88 (9.8)
Race/ethnicity									
White, non-Hispanic	1414 (8.4)	1506 (9.0)	865 (5.6)	8985 (52.4)	8687 (50.7)	1809 (22.2)	1821 (10.6)	1165 (6.8)	653 (4.3)
Black, non-Hispanic	175 (5.2)	156 (4.6)	95 (3.0)	934 (26.8)	1023 (29.4)	387 (15.2)	227 (6.5)	140 (4.0)	80 (2.5)
Other	361 (6.3)	375 (6.5)	225 (4.2)	2687 (45.4)	2613 (44.2)	640 (19.8)	468 (7.9)	279 (4.7)	156 (2.9)
Service branch									
Army	873 (8.5)	881 (8.6)	519 (5.5)	4978 (47.2)	4910 (46.6)	1148 (20.6)	998 (9.5)	699 (6.6)	390 (4.1)
Air Force	419 (5.2)	457 (5.7)	280 (3.7)	3567 (43.0)	3491 (42.1)	867 (18.4)	531 (6.4)	286 (3.5)	176 (2.3)
Navy and Coast Guard	486 (8.1)	513 (8.6)	282 (5.1)	3087 (50.8)	2974 (48.9)	661 (22.1)	732 (12.0)	414 (6.8)	220 (4.1)
Marine Corps	172 (10.8)	186 (11.7)	104 (7.3)	974 (60.1)	948 (58.5)	160 (24.8)	255 (15.7)	185 (11.4)	103 (7.6)
Cumulative deployment, d									
Nondeployed	1396 (7.3)	1485 (7.7)	850 (4.8)	8828 (44.9)	8671 (44.1)	2092 (19.3)	1820 (9.3)	1165 (5.9)	645 (3.6)
1-180	253 (6.9)	250 (6.8)	156 (4.6)	1981 (52.4)	1934 (51.1)	424 (23.5)	349 (9.3)	202 (5.4)	126 (3.7)
181-270	141 (9.6)	140 (9.5)	77 (5.8)	885 (58.5)	841 (55.6)	163 (26.0)	174 (11.5)	104 (6.9)	62 (4.6)
>270	160 (10.5)	162 (10.7)	102 (7.5)	912 (58.5)	877 (56.2)	157 (24.2)	173 (11.1)	113 (7.3)	56 (4.1)
History of mental disorders									
None	1591 (7.0)	1702 (7.5)	997 (4.7)	11 063 (47.3)	10 855 (46.5)	2465 (20.0)	1962 (8.4)	1236 (5.3)	723 (3.4)
Depression symptoms/ diagnosis	128 (9.1)	136 (9.7)	81 (6.3)	664 (46.1)	636 (44.1)	177 (22.8)	220 (15.3)	132 (9.2)	71 (5.8)
PTSD symptoms/ diagnosis	73 (14.3)	63 (12.4)	29 (6.7)	310 (59.3)	268 (51.2)	48 (22.5)	116 (22.2)	67 (12.8)	28 (6.9)
PTSD and depression symptoms/ diagnosis	115 (14.7)	100 (12.8)	58 (8.7)	389 (48.4)	377 (47.0)	101 (24.4)	168 (21.0)	120 (15.0)	54 (8.5)
Other mental health disorder symptoms or self-reported psychiatric medication use	43 (11.1)	36 (9.3)	20 (5.8)	180 (45.0)	187 (46.8)	45 (20.5)	50 (12.5)	29 (7.3)	13 (3.7)
Smoking status									
Nonsmoker	679 (4.4)	752 (4.8)	483 (3.2)	6207 (38.8)	6087 (38.1)	1654 (16.9)	1015 (6.4)	638 (4.0)	399 (2.7)
Past smoker	571 (9.3)	641 (10.4)	382 (6.8)	3485 (55.4)	3449 (54.8)	743 (26.5)	710 (11.3)	465 (7.4)	261 (4.7)
Current smoker	700 (16.9)	644 (15.5)	320 (9.3)	2914 (68.5)	2787 (65.5)	439 (32.7)	791 (18.6)	481 (11.3)	229 (6.6)
History of potential alcohol dependence[b]									
No	911 (4.3)	1095 (5.2)	768 (3.8)	8890 (40.9)	8911 (41.0)	2476 (19.3)	1091 (5.0)	776 (3.6)	568 (2.8)
Yes	1039 (22.1)	942 (20.0)	417 (11.4)	3716 (77.4)	3412 (71.0)	360 (33.1)	1425 (29.6)	808 (16.8)	321 (9.5)

Abbreviation: PTSD, posttraumatic stress disorder.
[a] Percentages reported are the proportion of individuals within each characteristic subgroup who reported the outcome.
[b] Potential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.[29,30]

with a positive result on the CAGE questionnaire. Among Reserve/Guard personnel, baseline, follow-up, and new-onset prevalence of all outcomes was highest among those who were deployed with combat exposures, were younger, were Marines, had PTSD or PTSD and depression, were current smokers, and had a positive result on the CAGE questionnaire (**TABLE 3**).

In the model analyses of all 3 alcohol outcomes, the interaction term between deployment and service component was statistically significant ($P<.10$), whereas the interaction term between deployment and service branch was not, and thus the models were stratified only by active duty and Reserve/Guard status. Cumulative deployment length was collinear with deployment status and was removed from any modeling consideration. After assessing confounding, all covariates remained in the model because of the number of models and the lack of consistency between covariates that were candidates for removal.

Among active-duty personnel, deployment status was associated with binge drinking after adjustment (**TABLE 4**). Those deployed with combat exposures were at increased odds of new-onset binge drinking at follow-up (odds ratio [OR]=1.31; 95% confidence interval [CI], 1.14-1.49). Women were 1.21 times more likely to report new-onset heavy weekly drinking (95% CI, 1.04-1.39), whereas they were significantly less likely to report new-onset or changes in binge drinking or alcohol-related problems. Those born after 1980 were at 6.72 increased odds of new-onset binge drinking (95% CI, 5.33-8.46) and 4.67 increased odds of new-onset alcohol-related problems (95% CI, 3.36-6.47). Those with PTSD and depression were at increased odds of new-onset and continued alcohol-related problems at follow-up. Current smokers and individuals with a positive CAGE result at baseline were at increased odds for new-onset and continuation of all 3 drinking outcomes.

Among Reserve/Guard personnel, deployment with combat exposures was

associated with increased odds of new onset of all 3 drinking outcomes compared with nondeployed personnel, with heavy weekly drinking (OR=1.63; 95% CI, 1.36-1.96) and alcohol-related problems (OR=1.63; 95% CI, 1.33-2.01) showing the strongest association (**TABLE 5**). The subgroups at risk for new-onset and continued alcohol problems were similar to those reported from the active duty models and included younger age, current smoking, and individuals with a positive CAGE result. Additionally, those reporting any mental health symptoms, diagnoses, or medication use were at significantly increased risk for new-onset alcohol-related problems at follow-up.

COMMENT

Alcohol misuse has been among the concerns reported by soldiers returning from deployment,[10] yet research to date has not been able to quantify the relationship between alcohol problems and deployment. To our knowledge, this is the first study to prospectively investigate alcohol misuse in relation to deployment using 3 different metrics in a large population-based military cohort of both active-duty and Reserve/Guard personnel by documenting alcohol use patterns before and after deployment related to the wars in Iraq and Afghanistan. This study found a significantly increased risk for new-onset heavy weekly drinking, binge drinking, and other alcohol-related problems among Reserve/Guard personnel deployed with reported combat exposures compared with nondeployed Reserve/Guard personnel.

Increased alcohol outcomes among Reserve/Guard personnel deployed with combat exposures is concerning in light of increased reliance on Reserve/Guard forces supporting current operational requirements. This finding is consistent with a recently published study of soldiers returning from Iraq, in which endorsement of alcohol problems according to a 2-item alcohol screen in the newly implemented Post-

Deployment Health Reassessment was reported to be 11.8% for active duty and 15.0% for Reserve/Guard.[10] A study examining the baseline prevalence of mental health in the Millennium Cohort showed that the weighted prevalence of alcohol-related problems, defined as endorsing one of 5 Patient Health Questionnaire measures, was lower in regular active-duty members (11.5%) compared with Reserve/Guard members (14.1%).[61] Possible explanations for increased risk for new-onset drinking outcomes in Reserve/Guard members after deployment include inadequate training and preparation of civilian soldiers for the added stresses of combat exposures faced during deployment; increased stress among individuals and their families having to transition between military and civilian occupational settings; military unit cohesiveness; and reduced access to support services, including family services, health and physical fitness programs, and ongoing prevention programs in civilian communities.[10,62]

Other demographic and military characteristics associated with changes in drinking behavior include younger age, sex, race/ethnicity, and service branch. Increased risk for alcohol problems in younger personnel is not surprising when it is compared with that of other young cohorts and reported high binge-drinking levels.[63] Interventions focused on drinking reduction in younger cohorts that have been effective should be considered in young military personnel before, during, and after deployment. Women were significantly more likely to start drinking heavily but less likely to start binge drinking or have alcohol-related problems compared with men, which may be due to women turning to drinking as a coping mechanism, whereas men may have a higher propensity for risk-taking behaviors.[64,65] Sex-specific educational programs for interventions to reduce drinking may be considered. Our finding that whites were at increased risk for drinking outcomes compared with blacks or other races is consistent with past research.[38,41,42] Active-duty

Table 3. Prevalence of Baseline, Follow-up, and New-Onset Alcohol Use of Reserve/Guard Millennium Cohort Participants Reporting Outcomes

	No. (%)[a]								
	Heavy Weekly Drinkers			**Binge Drinkers**			**>1 Drinking-Related Problem**		
Characteristic	Baseline (n = 1791)	Follow-up (n = 2022)	New Onset (n = 1075)	Baseline (n = 9216)	Follow-up (n = 9291)	New Onset (n = 2264)	Baseline (n = 2736)	Follow-up (n = 1735)	New Onset (n = 776)
Deployment status									
Nondeployed	1415 (8.3)	1566 (9.2)	801 (5.1)	6997 (39.9)	7105 (40.6)	1804 (17.1)	2099 (12.0)	1322 (7.6)	588 (3.8)
Deployed without combat exposures	193 (9.0)	201 (9.4)	110 (5.6)	1100 (50.0)	1078 (49.0)	212 (19.3)	320 (14.6)	166 (7.6)	62 (3.3)
Deployed with combat exposures	183 (9.0)	255 (12.5)	164 (8.8)	1119 (53.6)	1108 (53.0)	248 (25.6)	317 (15.2)	247 (11.9)	126 (7.1)
Sex									
Male	1227 (8.3)	1381 (9.4)	735 (5.4)	7279 (48.0)	7309 (48.2)	1561 (19.8)	2142 (14.2)	1372 (9.1)	584 (4.5)
Female	564 (8.7)	641 (9.9)	340 (5.8)	1937 (29.1)	1982 (29.8)	703 (14.9)	594 (9.0)	363 (5.5)	192 (3.2)
Birth, y									
Before 1960	630 (7.6)	732 (8.9)	334 (4.4)	2615 (30.8)	2683 (31.6)	742 (12.6)	711 (8.4)	454 (5.4)	214 (2.8)
1960-1969	586 (7.4)	679 (8.6)	367 (5.0)	3590 (44.3)	3649 (45.0)	928 (20.6)	953 (11.8)	590 (7.3)	269 (3.8)
1970-1979	464 (10.8)	470 (10.9)	271 (7.1)	2544 (57.8)	2430 (55.2)	450 (24.3)	886 (20.2)	554 (12.6)	227 (6.5)
1980 and later	111 (14.0)	141 (17.7)	103 (15.1)	467 (57.4)	529 (65.1)	144 (41.6)	186 (23.0)	137 (16.9)	66 (10.6)
Race/ethnicity									
White, non-Hispanic	1539 (9.1)	1744 (10.4)	910 (5.9)	7761 (44.9)	7738 (44.8)	1764 (18.5)	2296 (13.3)	1420 (8.2)	614 (4.1)
Black, non-Hispanic	115 (5.0)	117 (5.1)	66 (3.0)	547 (22.8)	633 (26.4)	265 (14.3)	167 (7.0)	129 (5.4)	70 (3.2)
Other	137 (6.7)	161 (7.8)	99 (5.2)	908 (42.5)	920 (43.1)	235 (19.1)	273 (12.8)	186 (8.7)	92 (4.9)
Service branch									
Army	1114 (9.2)	1199 (10.0)	639 (5.8)	5383 (43.3)	5480 (44.1)	1362 (19.3)	1670 (13.5)	1108 (8.9)	497 (4.6)
Air Force	438 (7.2)	539 (8.9)	285 (5.1)	2536 (40.8)	2531 (40.7)	594 (16.1)	665 (10.7)	381 (6.1)	173 (3.1)
Navy and Coast Guard	187 (7.0)	231 (8.7)	127 (5.1)	1054 (38.6)	1044 (38.2)	269 (16.0)	303 (11.1)	178 (6.5)	79 (3.3)
Marine Corps	52 (12.3)	53 (12.5)	24 (6.5)	243 (56.1)	236 (54.5)	39 (20.5)	98 (22.6)	68 (15.7)	27 (8.0)
Cumulative deployment, d									
Nondeployed	1415 (8.3)	1566 (9.2)	801 (5.1)	6997 (39.9)	7105 (40.6)	1804 (17.1)	2099 (12.0)	1322 (7.6)	588 (3.8)
1-180	203 (8.7)	233 (9.9)	132 (6.2)	1197 (49.8)	1184 (49.2)	244 (20.2)	323 (13.5)	194 (8.1)	88 (4.2)
181-270	87 (10.7)	92 (11.3)	57 (7.8)	430 (52.0)	443 (53.6)	101 (25.4)	132 (16.0)	89 (10.8)	39 (5.6)
>270	86 (8.4)	131 (12.8)	85 (9.0)	592 (56.0)	559 (52.9)	115 (24.7)	182 (17.3)	130 (12.4)	61 (7.0)
History of mental disorders									
None	1422 (7.7)	1691 (9.2)	926 (5.5)	7979 (42.2)	8058 (42.6)	1937 (17.7)	2162 (11.5)	1360 (7.2)	623 (3.7)
Depression symptoms/ diagnosis	164 (11.9)	153 (11.1)	67 (5.5)	548 (38.8)	564 (39.9)	162 (18.7)	253 (17.9)	158 (11.2)	65 (5.6)
PTSD symptoms/ diagnosis	62 (14.7)	50 (11.9)	23 (6.4)	216 (49.7)	208 (47.8)	56 (25.6)	103 (23.7)	62 (14.3)	27 (8.2)
PTSD and depression symptoms/diagnosis	100 (16.2)	88 (14.2)	39 (7.5)	307 (47.7)	298 (46.4)	67 (19.9)	157 (24.5)	111 (17.3)	41 (8.5)
Other mental health disorder symptoms or self-reported psychiatric medication use	43 (11.4)	40 (10.6)	20 (6.0)	166 (42.5)	163 (41.7)	42 (18.7)	61 (15.6)	44 (11.3)	20 (6.1)
Smoking status									
Nonsmoker	654 (5.3)	802 (6.4)	495 (4.2)	4562 (35.6)	4618 (36.0)	1275 (15.4)	1200 (9.4)	794 (6.2)	382 (3.3)
Past smoker	575 (10.6)	631 (11.6)	316 (6.5)	2637 (47.4)	2675 (48.1)	605 (20.7)	797 (14.3)	461 (8.3)	210 (4.4)
Current smoker	562 (16.9)	589 (17.7)	264 (9.6)	2017 (59.0)	1998 (58.4)	384 (27.4)	739 (21.7)	480 (14.1)	184 (6.9)
History of potential alcohol dependence[b]									
No	749 (4.3)	1042 (6.0)	700 (4.2)	6240 (35.0)	6491 (36.4)	1943 (16.8)	1250 (7.0)	864 (4.9)	515 (3.1)
Yes	1042 (26.7)	980 (25.1)	375 (13.1)	2976 (74.5)	2800 (70.1)	321 (31.4)	1486 (37.1)	871 (21.8)	261 (10.4)

Abbreviation: PTSD, posttraumatic stress disorder.
[a] Percentages reported are the proportion of individuals within each characteristic subgroup that reported the outcome.
[b] Potential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.[29,30]

Marines were also found to be at increased odds of continuing to binge drink after deployment, as well as to experience new-onset alcohol-related problems. Marines may represent another group that should be targeted for interventions because the Hoge et al[9] study also showed a higher likelihood of alcohol misuse among Marines than Army personnel after deployment.

Individuals with previous mental health or alcohol problems were at significantly increased risk for changes in drinking behavior. Among CAGE/alcohol-positive individuals at baseline, risk for new-onset and continued drinking at follow-up was high for all 3 outcomes, potentially representing

Table 4. Adjusted Odds of New-Onset and Continued Alcohol Outcomes Among Active-Duty Millennium Cohort Participants From Baseline to Follow-up

	OR (95% CI)[a]					
	Heavy Weekly Drinking (n = 25 901)		Binge Drinking (n = 26 536)		Alcohol-Related Problems (n = 26 519)	
Characteristic	New Onset at Follow-up (n = 23 951)	Continued at Follow-up (n = 1950)	New Onset at Follow-up (n = 13 930)	Continued at Follow-up (n = 12 606)	New Onset at Follow-up (n = 24 003)	Continued at Follow-up (n = 2516)
Deployment status						
Nondeployed	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Deployed without combat exposures	1.11 (0.92-1.33)	0.81 (0.60-1.09)	1.07 (0.94-1.22)	1.08 (0.95-1.22)	0.85 (0.68-1.06)	0.88 (0.66-1.18)
Deployed with combat exposures	1.12 (0.94-1.33)	0.86 (0.66-1.13)	1.31 (1.14-1.49)	1.07 (0.95-1.21)	1.03 (0.85-1.26)	0.84 (0.64-1.09)
Sex						
Male	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Female	1.21 (1.04-1.39)	0.81 (0.65-1.01)	0.57 (0.52-0.63)	0.52 (0.47-0.58)	0.69 (0.58-0.83)	0.71 (0.55-0.91)
Birth, y						
Before 1960	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1960-1969	1.13 (0.92-1.38)	0.56 (0.40-0.77)	1.67 (1.47-1.90)	1.17 (1.02-1.36)	1.15 (0.89-1.48)	0.66 (0.47-0.92)
1970-1979	1.39 (1.14-1.70)	0.37 (0.27-0.51)	2.55 (2.22-2.92)	1.41 (1.22-1.63)	2.40 (1.87-3.07)	0.84 (0.61-1.16)
1980 and later	2.41 (1.81-3.22)	0.34 (0.22-0.52)	6.72 (5.33-8.46)	1.79 (1.41-2.27)	4.67 (3.36-6.47)	1.45 (0.95-2.20)
Race/ethnicity						
White, non-Hispanic	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Black, non-Hispanic	0.60 (0.48-0.75)	0.65 (0.46-0.92)	0.74 (0.65-0.85)	0.70 (0.60-0.82)	0.71 (0.56-0.91)	1.00 (0.72-1.38)
Other	0.78 (0.66-0.91)	0.87 (0.68-1.13)	0.99 (0.88-1.11)	0.89 (0.80-0.99)	0.72 (0.59-0.87)	0.92 (0.72-1.17)
Service branch[b]						
Army	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Air Force	0.65 (0.55-0.76)	1.02 (0.79-1.33)	0.87 (0.78-0.97)	0.93 (0.83-1.04)	0.58 (0.48-0.71)	0.66 (0.50-0.86)
Navy and Coast Guard	0.83 (0.71-0.97)	1.11 (0.87-1.42)	1.08 (0.95-1.21)	0.95 (0.84-1.06)	0.95 (0.80-1.14)	0.83 (0.66-1.05)
Marine Corps	1.11 (0.89-1.40)	1.23 (0.87-1.73)	1.06 (0.86-1.29)	1.20 (1.00-1.44)	1.48 (1.17-1.88)	0.97 (0.72-1.32)
History of mental disorders[b]						
None	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Depression symptoms/diagnosis	1.06 (0.83-1.35)	0.93 (0.63-1.37)	1.18 (0.98-1.42)	0.75 (0.63-0.90)	1.67 (1.28-2.17)	1.02 (0.73-1.41)
PTSD symptoms/diagnosis	0.95 (0.64-1.40)	1.02 (0.63-1.66)	0.93 (0.67-1.31)	0.64 (0.49-0.82)	1.43 (0.95-2.14)	1.14 (0.75-1.72)
PTSD and depression symptoms/diagnosis	1.30 (0.98-1.74)	0.67 (0.44-1.01)	1.07 (0.84-1.36)	0.71 (0.56-0.89)	2.18 (1.61-2.95)	1.48 (1.05-2.09)
Other mental health disorder symptoms or self-reported psychiatric medication use	1.05 (0.66-1.67)	0.64 (0.34-1.23)	1.07 (0.76-1.51)	1.18 (0.82-1.71)	1.06 (0.60-1.88)	1.21 (0.65-2.25)
Smoking status[b]						
Nonsmoker	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Past smoker	1.94 (1.68-2.24)	1.20 (0.95-1.51)	1.79 (1.61-1.99)	1.37 (1.24-1.52)	1.53 (1.30-1.81)	1.23 (0.98-1.53)
Current smoker	2.43 (2.08-2.83)	1.45 (1.16-1.82)	2.20 (1.92-2.50)	1.60 (1.43-1.79)	1.85 (1.55-2.20)	1.30 (1.05-1.62)
History of potential alcohol dependence[b,c]						
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	2.84 (2.50-3.23)	1.72 (1.42-2.08)	2.01 (1.74-2.31)	1.75 (1.59-1.93)	3.19 (2.75-3.69)	2.10 (1.73-2.54)

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, posttraumatic stress disorder.
[a] Odds ratios and associated 95% CIs were adjusted for all other variables in the table.
[b] Characteristic reported at baseline assessment.
[c] Potential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.[29,30]

vulnerability toward drinking in these individuals. Those with baseline symptoms of depression or PTSD and depression were also at increased risk for new-onset alcohol-related problems in active duty and Reserve/ Guard. Among Reserve/Guard, the risk for new-onset alcohol-related problems was significant for those with any report of mental health symptoms or medication use, possibly because of the difficulties of work and family responsibilities that shift quickly. Research has suggested that PTSD is associated with changes in alcohol consumption[5] and that alcohol misuse is comorbid with several mental health disorders.[5,6] However, it is difficult to separate any clear

Table 5. Adjusted Odds of New-Onset and Continued Alcohol Outcomes Among Reserve/Guard Millennium Cohort Participants From Baseline to Follow-up

| | OR (95% CI)[a] | | | | | |
| | Heavy Weekly Drinking (n = 21 211) | | Binge Drinking (n = 21 812) | | Alcohol-Related Problems (n = 21 761) | |
Characteristic	New Onset at Follow-up (n = 19 420)	Continued at Follow-up (n = 1791)	New Onset at Follow-up (n = 12 596)	Continued at Follow-up (n = 9216)	New Onset at Follow-up (n = 19 025)	Continued at Follow-up (n = 2736)
Deployment status						
Nondeployed	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Deployed without combat exposures	1.09 (0.88-1.36)	0.66 (0.48-0.91)	1.10 (0.93-1.30)	1.12 (0.95-1.32)	0.88 (0.67-1.16)	0.96 (0.73-1.25)
Deployed with combat exposures	1.63 (1.36-1.96)	0.97 (0.70-1.34)	1.46 (1.24-1.71)	0.95 (0.81-1.11)	1.63 (1.33-2.01)	1.11 (0.86-1.43)
Sex						
Male	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Female	1.22 (1.06-1.41)	1.24 (1.00-1.55)	0.62 (0.55-0.68)	0.49 (0.43-0.55)	0.66 (0.55-0.79)	0.65 (0.53-0.81)
Birth, y						
Before 1960	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1960-1969	1.14 (0.98-1.34)	0.68 (0.54-0.87)	2.00 (1.80-2.24)	1.24 (1.10-1.40)	1.44 (1.19-1.73)	0.99 (0.80-1.23)
1970-1979	1.56 (1.32-1.86)	0.43 (0.33-0.56)	2.69 (2.34-3.09)	1.49 (1.30-1.70)	2.55 (2.09-3.12)	1.16 (0.93-1.45)
1980 and later	3.74 (2.90-4.83)	0.27 (0.17-0.43)	6.90 (5.42-8.79)	2.27 (1.74-2.97)	4.82 (3.53-6.57)	1.33 (0.93-1.90)
Race/ethnicity						
White, non-Hispanic	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Black, non-Hispanic	0.54 (0.42-0.70)	0.62 (0.42-0.92)	0.80 (0.69-0.92)	0.65 (0.54-0.79)	0.92 (0.71-1.19)	0.96 (0.68-1.34)
Other	0.89 (0.71-1.10)	0.72 (0.50-1.04)	1.04 (0.89-1.22)	0.96 (0.81-1.13)	1.29 (1.03-1.63)	0.95 (0.73-1.25)
Service branch[b]						
Army	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Air Force	1.00 (0.85-1.17)	1.31 (1.02-1.67)	0.91 (0.81-1.02)	1.03 (0.91-1.16)	0.85 (0.70-1.03)	0.85 (0.69-1.05)
Navy and Coast Guard	1.01 (0.82-1.23)	1.07 (0.77-1.48)	0.91 (0.78-1.05)	0.88 (0.76-1.03)	0.85 (0.66-1.09)	0.86 (0.65-1.12)
Marine Corps	0.91 (0.59-1.41)	1.48 (0.83-2.63)	0.86 (0.59-1.24)	1.09 (0.78-1.53)	1.39 (0.91-2.12)	1.14 (0.74-1.73)
History of mental disorders[b]						
None	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Depression symptoms/diagnosis	0.82 (0.63-1.07)	0.74 (0.52-1.04)	1.09 (0.91-1.32)	0.88 (0.72-1.08)	1.56 (1.18-2.05)	1.15 (0.87-1.53)
PTSD symptoms/diagnosis	0.89 (0.58-1.39)	0.54 (0.32-0.92)	1.32 (0.95-1.82)	0.65 (0.48-0.89)	1.90 (1.25-2.87)	0.94 (0.61-1.45)
PTSD and depression symptoms/diagnosis	1.15 (0.81-1.62)	0.76 (0.50-1.16)	1.08 (0.81-1.43)	0.85 (0.65-1.12)	2.33 (1.66-3.28)	1.41 (1.01-1.97)
Other mental health disorder symptoms or self-reported psychiatric medication use	0.98 (0.61-1.56)	0.61 (0.33-1.14)	1.19 (0.84-1.68)	0.81 (0.57-1.16)	1.85 (1.15-2.96)	1.20 (0.70-2.04)
Smoking status[b]						
Nonsmoker	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Past smoker	1.51 (1.30-1.76)	1.28 (1.01-1.62)	1.58 (1.41-1.77)	1.37 (1.21-1.54)	1.31 (1.10-1.57)	0.85 (0.70-1.04)
Current smoker	2.16 (1.84-2.54)	1.79 (1.41-2.28)	2.13 (1.85-2.44)	1.49 (1.31-1.70)	1.88 (1.56-2.27)	1.21 (1.00-1.47)
History of potential alcohol dependence[b,c]						
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	3.34 (2.91-3.83)	1.69 (1.38-2.06)	2.30 (1.98-2.66)	1.87 (1.67-2.10)	3.44 (2.93-4.03)	1.78 (1.51-2.10)

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, posttraumatic stress disorder.
[a] Odds ratios and associated 95% CIs were adjusted for all other variables in the table.
[b] Characteristic reported at baseline assessment.
[c] Potential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions.[29,30]

causal pathways because the etiology of these disorders is likely intertwined.

Unfortunately, a simple solution to mitigating the effects of these comorbidities among military personnel has yet to be discovered, and research has identified difficulties in reducing stigma and barriers to care.[8-10] A recent report showed that although the military has reduced smoking and other drug use, progress remains slow on reduction in heavy drinking.[66] Continued screening using such items as the Post-Deployment Health Reassessment, given 3 to 6 months after deployment, will help to identify at-risk individuals who may need to seek treatment. As Milliken et al[10] suggested, it is important that the military establish policies endorsing "confidentiality" and "self-referral" for optimal effectiveness. A potentially interesting strategy to aid problem drinkers is self-help, Web-based intervention.[67] This method was tested in a controlled trial, showed efficacy in drinking reduction, and could be promising for use among military personnel because of perceived privacy of a Web-based tool. Another potential strategy to reduce drinking involves assessing "drinking motivation type (experimenters, thrill seekers, multireasoners, and relaxers)" and then targeting interventions according to a person's profile.[68] Finally, a technique called the brief negotiated interview, proposed by Fernandez et al,[69] uses a "method designed to enhance a patient's motivation to change, rooted in the principles of motivational interviewing." This method might be useful for the military in settings in which one-on-one interaction is feasible because development of rapport with the individual is a key to this method.

Our study has several possible limitations. The Millennium Cohort may not be representative of the military as a whole or those who are deployed. However, thorough evaluations of possible biases suggest the cohort is a representative sample of military personnel, as measured by demographic and mental health characteristics and reliable health and exposure reporting.[18,61,70-74] Nondeployed individuals may not have deployed because they were unfit owing to health status, which means our comparison group may have been less healthy than our deployed groups, potentially biasing our results toward the null. Another important limitation is that the authors did not collect information on the circumstances under which the participants took the survey. Therefore, the various circumstances under which responses were reported, such as anxiety before war, may have influenced response. However, because both binge drinking and alcohol-related problems were related to behaviors during the past year, the effect of differing circumstances was likely minimal. Additionally, the average amount of time between returning home from deployment and completing the follow-up survey was 1 year, making it difficult to determine both short- and long-term effects of deployment on alcohol use. Self-reported data are subject to recall bias, and the actual number of drinks consumed in the past week may be difficult for participants to easily remember.[75,76] Measures of binge drinking also differed slightly between baseline and follow-up assessments. Although the core text of the questions ("5 or more drinks" in 1 day or on 1 occasion) was nearly identical, the response options were presented differently. Another potential limitation is that both questionnaires identify overall alcohol consumption, which has been shown to underestimate actual consumption compared with beverage-specific consumption questions.[75] It is also possible that military personnel are less likely to endorse alcohol-related questions because of concern that acknowledging risky behavior could hinder career progression. However, other studies have found that self-reported weekly alcohol consumption measures, even when service members know the survey is not anonymous, demonstrate good criterion-related validity.[31] Finally, although we collected data on several known and theoretical confounders, we did not have information on other drug use.

Despite these limitations, our study has important strengths. The Millennium Cohort has the advantage of being systematically drawn from all branches and components of the US military, yielding a large sample size with statistical power to detect meaningful differences among subgroups of this population. Additionally, data on quantity of drinking are strengthened by the use of different metrics (weekly drinking, daily drinking, and alcohol problems) to capture this information. Moreover, these data longitudinally measure heavy drinking, binge drinking, and drinking-related problems, independent of the timing of deployment, providing prospective insight into these outcomes and any relationship to military deployment in a large population-based sample. Further, alcohol use has been suggested as one possible explanation for previously unexplained increases in injury mortality subsequent to deployment.[77] Finally, although self-reported alcohol consumption may not be a perfect measure, other epidemiologic studies have found these measurements to be generally reliable.[78,79]

In conclusion, our study found that combat deployment in support of the wars in Iraq and Afghanistan was significantly associated with new-onset heavy weekly drinking, binge drinking, and other alcohol-related problems among Reserve/Guard and younger personnel after return from deployment. These results are the first to prospectively quantify changes in alcohol use in relation to recent combat deployments. Interventions should focus on at-risk groups, including Reserve/Guard personnel, younger individuals, and those with previous or existing mental health disorders. Further prospective analyses using Millennium Cohort data will evaluate timing, duration, and comorbidity of alcohol misuse and other-alcohol related problems, better defining the long-term effect of military combat deployments on these important health outcomes.

REFERENCES

1. Schuckit MA, Smith TL, Chacko Y. Evaluation of a depression-related model of alcohol problems in 430 probands from the San Diego prospective study. *Drug Alcohol Depend*. 2006;82(3):194-203.
2. Kozaric-Kovacic D, Ljubin T, Grappe M. Comorbidity of posttraumatic stress disorder and alcohol dependence in displaced persons. *Croat Med J*. 2000;41(2):173-178.
3. Shipherd JC, Stafford J, Tanner LR. Predicting alcohol and drug abuse in Persian Gulf War veterans: what role do PTSD symptoms play? *Addict Behav*. 2005;30(3):595-599.
4. Chilcoat HD, Breslau N. Investigations of causal pathways between PTSD and drug use disorders. *Addict Behav*. 1998;23(6):827-840.
5. McFarlane AC. Epidemiological evidence about the relationship between PTSD and alcohol abuse: the nature of the association. *Addict Behav*. 1998;23(6):813-825.
6. Ross HE. *DSM-III-R* alcohol abuse and dependence and psychiatric comorbidity in Ontario: results from the Mental Health Supplement to the Ontario Health Survey. *Drug Alcohol Depend*. 1995;39(2):111-128.
7. Swendsen JD, Merikangas KR, Canino GJ, et al. The comorbidity of alcoholism with anxiety and depressive disorders in four geographic communities. *Compr Psychiatry*. 1998;39(4):176-184.
8. Hoge CW, Auchterlonie JL, Milliken CS. Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA*. 2006;295(9):1023-1032.
9. Hoge CW, Castro CA, Messer SC, et al. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med*. 2004;351(1):13-22.
10. Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *JAMA*. 2007;298(18):2141-2148.
11. Smith TC, Ryan MA, Wingard DL, et al. New onset and persistent symptoms of post-traumatic stress disorder self reported after deployment and combat exposures: prospective population based US military cohort study. *BMJ*. 2008;336(7640):366-371.
12. Smith TC, Wingard DL, Ryan MA, et al. Prior assault and posttraumatic stress disorder after combat deployment. *Epidemiology*. 2008;19(3):505-512.
13. Goldberg J, Eisen SA, True WR, Henderson WG. A twin study of the effects of the Vietnam conflict on alcohol drinking patterns. *Am J Public Health*. 1990;80(5):570-574.
14. Richards MS, Goldberg J, Rodin MB, Anderson RJ. Alcohol consumption and problem drinking in white male veterans and nonveterans. *Am J Public Health*. 1989;79(8):1011-1015.
15. Self-reported illness and health status among Gulf War veterans: a population-based study. *JAMA*. 1997;277(3):238-245.
16. Engel CC Jr, Ursano R, Magruder C, et al. Psychological conditions diagnosed among veterans seeking Department of Defense care for Gulf War–related health concerns. *J Occup Environ Med*. 1999;41(5):384-392.
17. McLeod DS, Koenen KC, Meyer JM, et al. Genetic and environmental influences on the relationship among combat exposure, posttraumatic stress disorder symptoms, and alcohol use. *J Trauma Stress*. 2001;14(2):259-275.
18. Ryan MA, Smith TC, Smith B, et al. Millennium Cohort: enrollment begins a 21-year contribution to understanding the impact of military service. *J Clin Epidemiol*. 2007;60(2):181-191.
19. Dillman DA. *Mail and Telephone Surveys: The Total Design Method*. New York, NY: Wiley; 1978:xvi, 325.
20. Holmes TH, Rahe RH. The Social Readjustment Rating Scale. *J Psychosom Res*. 1967;11(2):213-218.
21. Hobson CJ, Kamen J, Szostek J, et al. Stressful life events: a revision and update of the Social Readjustment Rating Scale. *Int J Stress Manag*. 1998;5(1):1-23.
22. Weathers FW, Litz BT, Herman DS, et al. The PTSD Checklist (PCL): reliability, validity, and diagnostic utility. Paper presented at: Annual Meeting of International Society for Traumatic Stress Studies; October 1993; San Antonio, Texas.
23. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. Washington, DC: American Psychiatric Association; 1994.
24. Spitzer RL, Williams JB, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care: the PRIME-MD 1000 Study. *JAMA*. 1994;272(22):1749-1756.
25. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ Primary Care Study: Primary Care Evaluation of Mental Disorders. *JAMA*. 1999;282(18):1737-1744.
26. Spitzer RL, Williams JB, Kroenke K, et al. Validity and utility of the PRIME-MD patient health questionnaire in assessment of 3000 obstetric-gynecologic patients: the PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study. *Am J Obstet Gynecol*. 2000;183(3):759-769.
27. Fann JR, Bombardier CH, Dikmen S, et al. Validity of the Patient Health Questionnaire-9 in assessing depression following traumatic brain injury. *J Head Trauma Rehabil*. 2005;20(6):501-511.
28. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606-613.
29. Dhalla S, Kopec JA. The CAGE questionnaire for alcohol misuse: a review of reliability and validity studies. *Clin Invest Med*. 2007;30(1):33-41.
30. Ewing JA. Detecting alcoholism: the CAGE questionnaire. *JAMA*. 1984;252(14):1905-1907.
31. Bell NS, Williams JO, Senier L, et al. The reliability and validity of the self-reported drinking measures in the Army's Health Risk Appraisal survey. *Alcohol Clin Exp Res*. 2003;27(5):826-834.
32. US Department of Health and Human Services. *Dietary Guidelines for Americans, 2005*. 6th ed. Washington, DC: US Government Printing Office; 2005.
33. Dawson DA, Grant BF, Li TK. Quantifying the risks associated with exceeding recommended drinking limits. *Alcohol Clin Exp Res*. 2005;29(5):902-908.
34. Goldberg IJ, Mosca L, Piano MR, Fisher EA. AHA Science Advisory: wine and your heart: a science advisory for healthcare professionals from the Nutrition Committee, Council on Epidemiology and Prevention, and Council on Cardiovascular Nursing of the American Heart Association. *Circulation*. 2001;103(3):472-475.
35. Criqui MH. Do known cardiovascular risk factors mediate the effect of alcohol on cardiovascular disease? *Novartis Found Symp*. 1998;216:159-167.
36. Thun MJ, Peto R, Lopez AD, et al. Alcohol consumption and mortality among middle-aged and elderly US adults. *N Engl J Med*. 1997;337(24):1705-1714.
37. Naimi TS, Brewer RD, Mokdad A, et al. Binge drinking among US adults. *JAMA*. 2003;289(1):70-75.
38. Costanzo PR, Malone PS, Belsky D, et al. Longitudinal differences in alcohol use in early adulthood. *J Stud Alcohol Drugs*. 2007;68(5):727-737.
39. Lande RG, Marin BA, Chang AS, Lande GR. Gender differences and alcohol use in the US Army. *J Am Osteopath Assoc*. 2007;107(9):401-407.
40. Bray RM, Marsden ME, Peterson MR. Standardized comparisons of the use of alcohol, drugs, and cigarettes among military personnel and civilians. *Am J Public Health*. 1991;81(7):865-869.

41. Dawson DA. Beyond black, white and Hispanic: race, ethnic origin and drinking patterns in the United States. *J Subst Abuse*. 1998;10(4):321-339.

42. Gilman SE, Breslau J, Conron KJ, et al. Education and race-ethnicity differences in the lifetime risk of alcohol dependence. *J Epidemiol Community Health*. 2008;62(3):224-230.

43. Crum RM, Anthony JC. Educational level and risk for alcohol abuse and dependence: differences by race-ethnicity. *Ethn Dis*. 2000;10(1):39-52.

44. Crum RM, Bucholz KK, Helzer JE, Anthony JC. The risk of alcohol abuse and dependence in adulthood: the association with educational level. *Am J Epidemiol*. 1992;135(9):989-999.

45. Dawson DA, Grant BF, Stinson FS, Chou PS. Maturing out of alcohol dependence: the impact of transitional life events. *J Stud Alcohol*. 2006;67(2):195-203.

46. Ames GM, Cunradi CB, Moore RS, Stern P. Military culture and drinking behavior among US Navy careerists. *J Stud Alcohol Drugs*. 2007;68(3):336-344.

47. Micklewright S. Problem drinking in the Naval Service: a study of personnel identified as alcohol abusers. *J R Nav Med Serv*. 1996;82(1):34-40.

48. Vander Weg MW, DeBon M, Sherrill-Mittleman D, et al. Binge drinking, drinking and driving, and riding with a driver who had been drinking heavily among Air National Guard and Air Force Reserve Personnel. *Mil Med*. 2006;171(2):177-183.

49. Williams JO, Bell NS, Amoroso PJ. Drinking and other risk taking behaviors of enlisted male soldiers in the US Army. *Work*. 2002;18(2):141-150.

50. Cunradi CB, Moore RS, Ames G. Contribution of occupational factors to current smoking among active-duty US Navy careerists. *Nicotine Tob Res*. 2008; 10(3):429-437.

51. Rona RJ, Fear NT, Hull L, et al. Mental health consequences of overstretch in the UK armed forces. *BMJ*. 2007;335(7620):603.

52. Killgore WD, Cotting DI, Thomas JL, et al. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. *J Psychiatr Res*. 2008. doi:10 .1016/j.jpsychires.2008.01.001.

53. Shepherd J, Irish M, Scully C, Leslie I. Alcohol consumption among victims of violence and among comparable UK populations. *Br J Addict*. 1989;84(9): 1045-1051.

54. Ullman SE, Filipas HH, Townsend SM, Starzynski LL. Trauma exposure, posttraumatic stress disorder and problem drinking in sexual assault survivors. *J Stud Alcohol*. 2005;66(5):610-619.

55. Ullman SE, Filipas HH, Townsend SM, Starzynski LL. Correlates of comorbid PTSD and drinking problems among sexual assault survivors. *Addict Behav*. 2006;31(1):128-132.

56. Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of *DSM-IV* alcohol abuse and dependence in the United States. *Arch Gen Psychiatry*. 2007;64(7):830-842.

57. Agrawal A, Sartor C, Pergadia ML, Huizink AC, Lynskey MT. Correlates of smoking cessation in a nationally representative sample of US adults. *Addict Behav*. 2008. doi:1016/j.addbeh.2008.04.003.

58. Werner MJ, Walker LS, Greene JW. Concurrent and prospective screening for problem drinking among college students. *J Adolesc Health*. 1996;18(4): 276-285.

59. Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *Am J Epidemiol*. 1993; 138(11):923-936.

60. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. 4th ed. Lenexa, KS: American Association for Public Opinion Research; 2006. http://www.aapor.org/uploads /standarddefs_4.pdf. Accessed May 28, 2008.

61. Riddle JR, Smith TC, Smith B, et al. Millennium Cohort: the 2001-2003 baseline prevalence of mental disorders in the US military. *J Clin Epidemiol*. 2007; 60(2):192-201.

62. Wynd CA, Ryan-Wenger NA. The health and physical readiness of Army reservists: a current review of the literature and significant research questions. *Mil Med*. 1998;163(5):283-287.

63. White AM, Kraus CL, Swartzwelder H. Many college freshmen drink at levels far beyond the binge threshold. *Alcohol Clin Exp Res*. 2006;30(6):1006-1010.

64. Almeida-Filho N, Lessa I, Magalhães L, et al. Alcohol drinking patterns by gender, ethnicity, and social class in Bahia, Brazil. *Rev Saude Publica*. 2004; 38(1):45-54.

65. Hussong AM. Predictors of drinking immediacy following daily sadness: an application of survival analysis to experience sampling data. *Addict Behav*. 2007; 32(5):1054-1065.

66. Bray RM, Hourani LL. Substance use trends among active duty military personnel: findings from the United States Department of Defense Health Related Behavior Surveys, 1980-2005. *Addiction*. 2007;102(7): 1092-1101.

67. Riper H, Kramer J, Smit F, et al. Web-based self-help for problem drinkers: a pragmatic randomized trial. *Addiction*. 2008;103(2):218-227.

68. Coffman DL, Patrick ME, Palen LA, et al. Why do high school seniors drink? implications for a targeted approach to intervention. *Prev Sci*. 2007;8(4):241-248.

69. Fernandez WG, Hartman R, Olshaker J. Brief interventions to reduce harmful alcohol use among military personnel: lessons learned from the civilian experience. *Mil Med*. 2006;171(6):538-543.

70. LeardMann CA, Smith B, Smith TC, et al. Smallpox vaccination: comparison of self-reported and electronic vaccine records in the Millennium Cohort Study. *Hum Vaccin*. 2007;3(6):245-251.

71. Smith B, Leard CA, Smith TC, et al. Anthrax vaccination in the Millennium Cohort: validation and measures of health. *Am J Prev Med*. 2007;32(4):347-353.

72. Smith B, Smith TC, Gray GC, Ryan MA. When epidemiology meets the Internet: Web-based surveys in the Millennium Cohort Study. *Am J Epidemiol*. 2007; 166(11):1345-1354.

73. Smith TC, Jacobson IG, Smith B, Hooper TI, Ryan MA. The occupational role of women in military service: validation of occupation and prevalence of exposures in the Millennium Cohort Study. *Int J Environ Health Res*. 2007;17(4):271-284.

74. Smith TC, Smith B, Jacobson IG, Corbeil TE, Ryan MA. Reliability of standard health assessment instruments in a large, population-based cohort study. *Ann Epidemiol*. 2007;17(7):525-532.

75. Dawson DA. Methodological issues in measuring alcohol use. *Alcohol Res Health*. 2003;27(1): 18-29.

76. Heeb JL, Gmel G. Measuring alcohol consumption: a comparison of graduated frequency, quantity frequency, and weekly recall diary methods in a general population survey. *Addict Behav*. 2005;30 (3):403-413.

77. Bell NS, Amoroso PJ, Wegman DH, Senier L. Proposed explanations for excess injury among veterans of the Persian Gulf War and a call for greater attention from policymakers and researchers. *Inj Prev*. 2001; 7(1):4-9.

78. Carlsson S, Hammar N, Hakala P, et al. Assessment of alcohol consumption by mailed questionnaire in epidemiological studies: evaluation of misclassification using a dietary history interview and biochemical markers. *Eur J Epidemiol*. 2003;18 (6):493-501.

79. Williams GD, Aitken SS, Malin H. Reliability of self-reported alcohol consumption in a general population survey. *J Stud Alcohol*. 1985;46(3):223-227.

REPORT DOCUMENTATION PAGE

1. Report Date (DD MM YY) 06-02-08	2. Report Type New	3. DATES COVERED (from - to) Dec 2006 – Feb 2008

4. TITLE AND SUBTITLE
Alcohol Use and Alcohol-Related Problems before and after Military Combat Deployment

5a. Contract Number:
5b. Grant Number:
5c. Program Element:
5d. Project Number:
5e. Task Number:
5f. Work Unit Number: 60002

6. AUTHORS
Isabel G. Jacobson, MPH; Margaret A. K. Ryan, MD, MPH; Tomoko I. Hooper, MD, MPH; Tyler C. Smith, MS, PhD; Paul J. Amoroso, MD, MPH; Edward J. Boyko, MD, MPH; Gary D. Gackstetter, DVM, MPH, PhD; Timothy S. Wells, DVM, MPH, PhD; and Nicole S. Bell, ScD, MPH; For the Millennium Cohort Study Team

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Commanding Officer
Naval Health Research Center
140 Sylvester Road
San Diego, CA 92106-3521

8. PERFORMING ORGANIZATION REPORT NUMBER
Report No. 08-08

8. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)

Commanding Officer	Commander
Naval Medical Research Center	Navy Medicine Support Command
503 Robert Grant Ave	P.O. Box 140
Silver Spring, MD 20910-7500	Jacksonville, FL 32213-0140

10. Sponsor/Monitor's Acronyms(s)
NMRC/NMSC

11. Sponsor/Monitor's Report Number(s)

12 DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution is unlimited.

13. SUPPLEMENTARY NOTES
Published in JAMA, 2008, 300(6), 663-675

14. ABSTRACT (maximum 200 words)

Background: Concern has grown over the health of US service members returning from deployment in support of the wa[r in] Afghanistan. High rates of alcohol misuse after deployment have been reported among personnel returning from past confl[ict] focusing on alcohol misuse after returning from the current conflicts are lacking.

Methods: The Millennium Cohort Study is a population-based, longitudinal study designed to evaluate any long-term effec[t] Our analyses included 48 481 participants with complete outcome and demographic data who also completed both baseline surveys. Outcomes were new-onset of heavy weekly drinking, potential binge drinking, and other alcohol-related problems.

Results: Men and women who were deployed and reported combat exposures were significantly more likely to experience alcohol outcomes compared with nondeployed personnel.

Conclusions: Deployment with combat-related exposures appears to increase the risk of new-onset of heavy weekly drin[king] drinking, and other alcohol-related problems. Continued prospective analyses of these data are essential to understand ho[w] influence short- and long-term alcohol use patterns.

14. SUBJECT TERMS
alcohol drinking, military personnel, military medicine, prospective studies

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	18a. NAME OF RESPONSIBLE PERSON
a. REPORT UNCL	b.ABSTRACT UNCL	b. THIS PAGE UNCL	UNCL	14	Commanding Officer

18b. TELEPHONE NUMBER (INCLUDING AREA CODE)
COMM/DSN: (619) 553-8429

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18